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Capelin in SA2 + Div. 3K

by

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Abstract

This paper documents recent information relevant to capelin in SA2 + Div. 3K. Part A provides information on catch trends and TAC's in both the inshore and offshore areas from 1976-86.

Part B presents data on the offshore fishery and groundfish surveys. The geographical and seasonal pattern of the offshore catch in 1986 is similar to that during 1972-78 although the 1986 catch is much lower. The commercial catch rates increased in 1986, however, there is a discrepancy between observer data and NAFO data for 1985. The offshore commercial catch was dominated by the 1983 year-class (69%) followed by the 1984 year-class (21%) and the 1982 year-class (8%). This contribution by the two-year-olds was the weakest since 1978. Distribution of capelin catches during groundfish surveys compared to the Canadian acoustic survey indicated that the acoustic survey coverage was better in Div. 2J than Div. 3K.

Part C presents information from the 1986 inshore fishery in Div. 3K. The 1986 inshore catch was dominated by the 1983 year-class with the 1982 year-class next in abundance. Reported discards for all gear types declined from 1985 levels. Catch rates in 1986 increased for purse seines and traps but decreased for beach seines.

Part D describes the 1986 hydroacoustic survey of capelin in NAFO Div. 2J3K. Total capelin biomass was estimated at about 431,000 t and three-year-old capelin dominated.

RESUME

La présente communication vient compléter l'information récente obtenue relativement au capelan dans la sous-zone 2 et la division 3K. La partie A fournit de l'information sur les tendances des prises et le total des prises admissibles dans les régions côtières ou au large pour la période comprise entre 1976 et 1986.

La partie B présente des données sur la pêche hauturière et sur les relevés effectués sur les poissons de fond. La situation géographique et saisonnière des prises au large en 1986 est semblable à celle qui prévalait de 1972 à 1978, bien que les prises de 1986 soient beaucoup plus faibles. Les taux de capture de la pêche commerciale ont augmenté en 1986 bien que les données des observateurs et les données de l'OPANO pour 1985 ne concordent pas tout à fait. La prise commerciale au large a été dominée par la classe d'âge de 1983 (69 %) suivie par la classe d'âge de 1984 (21 %) et la classe d'âge de 1982 (8 %). Depuis 1978, c'est la première fois que la contribution des poissons de deux ans est aussi faible. Si l'on compare la répartition des prises de capelan observée pendant les relevés sur les poissons de fond aux résultats du relevé acoustique canadien, on constate que le relevé acoustique avait permis d'assurer une meilleure couverture de la divisions 2J que de la division 3K.

La partie C contient de l'information sur la pêche côtière en 1986 dans la division 3K. En 1986, les prises provenant de la pêche côtière ont été dominées par la classe d'âge de 1983, la classe d'âge de 1982 étant la deuxième en abondance. Les taux de poissons rejetés pour tous les types d'engins de pêche ont diminué par rapport à 1985. Les taux de capture ont augmenté en 1986 pour les sennes coulissantes et les trappes, mais ont diminué pour les sennes de rivage.

La partie D décrit le relevé hydroacoustique effectué en 1986 pour le capelan dans la division 2J3K de l'OPANO. La biomasse totale du capelan a été évaluée à environ 431 000 t et le capelan de trois ans dominait.

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Introduction

This document provides information pertinent to the capelin stock occurring in NAFO SA2 + Div. 3K. Catch information is found in Part A. Part B* of this paper updates information found in Carscadden and Atkinson (1986) and includes commercial catch rates and age compositions from the offshore fishery, a comparison of the areal coverge of the commercial fishery and the Canadian acoustic survey and distribution of capelin catches from the Canadian groundfish research surveys. Part C* summarizes the events of the 1986 inshore fishery, presents age-composition data derived from commercial samples and analyzes research logbook data submitted by commercial fishermen. Part D* presents the results of an acoustic survey conducted by Canada during the fall of 1986.

A. Catch trends

The capelin fishery in NAFO SA2 + Div. 3K was, until 1972, a small inshore domestic fishery occurring during the spawning season. In 1972, substantial offshore catches were reported. These catches peaked in 1976 at 212,000 t and declined during the late 1970's to 11,000 t in 1979. These offshore catches were taken mostly by USSR midwater trawlers. During 1980-82, the only directed offshore catches were taken in an experimental USSR midwater trawl fishery.

Since 1983, all offshore catches have been taken by USSR midwater trawlers. In most years, the offshore fishery occurred during August-December with peak catches occurring in September-November (Fig. 1). During 1972-78 and 1983, 1984, and 1986, catches occurred in both Div. 2J and 3K but during 1979-82 and 1985, catches occurred in Div. 2J only.

In recent years, a small directed inshore fishery for roe has been conducted during June and July. Capelin landings in SA2 + Div. 3K during the inshore fishery in 1986 were the highest in the series (Table 1). In some years, opening dates of the fishery were fixed in advance but varied between areas while in other years, the opening dates were variable and were determined based on market acceptability of capelin. In 1986 DFO did not monitor capelin for maturity or redfeed content and opened all areas to fishing on June 1, 1986.

The inshore fishery experienced a dramatic increase in fixed gear licenses issued in 1986 which went from 270 in 1985 to 801 in 1986. Mobile licenses exhibited a small increase from 51 in 1985 to 64 in 1986.

Total inshore landings in SA2 + Div. 3K were almost completely taken in Div. 3K with capelin trap landings showing a steady increase since 1984 (Table 1). For Newfoundland fishermen, the fishery was quite lucrative in 1986 with a doubling of the tonnage of frozen females sold at 30,870 t compared to the 1985 estimate of 14,315 t. Average prices paid per pound to fishermen also doubled to 13.3¢ compared to 7.9¢ paid in 1985. These figures were from the Newfoundland Region (stock areas include 2 + 3K, 3L, 3Ps) and the 1986 estimates are preliminary and subject to revision.

The offshore fishery first came under quota regulation in 1974 and the inshore fishery in 1982. A summary of catches and TAC's ('000 t) since 1976 are shown below.

* Part B - J. Carscadden, D. B. Atkinson
Part C - B. Nakashima, R. Harnum
Part D - D. S. Miller

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Offshore											
TAC	160*	212*	212	75	5	10	10	10	17	17	17
Nominal catch	214	150	53	11	5	10	10	10	17	17**	17**
Inshore											
TAC							3	11	8	8	19
Nominal catch	2	2	2	1	1	2	4	4	7	7**	12**

* countries without specific allocations could each take up to 10,000 t beyond the allocated TAC

** preliminary

B. Offshore Commercial Fishery and Groundfish Surveys

i) Offshore Commercial Fishery

Pattern of the Offshore Fishery in 1986

The 1986 offshore catch occurred in both Div. 2J and Div. 3K (Fig. 1) with the Div. 2J catches occurring earlier in the season. This pattern is reminiscent of the pattern of the fishery during 1972-78 although current catches are generally much lower.

The distribution of samples collected by Foreign Cooperative Research Section in relation to the 1986 Canadian acoustic survey is shown in Figure 2. This figure illustrates the general southward seasonal movement of the commercial fleet. The acoustic survey is conducted in October and it would appear that the survey provides reasonable coverage of the capelin concentrations, assuming that the commercial fleet is targeting on the largest capelin concentrations.

Catch rates

Commercial catch rates have been calculated from a number of different sources. One series (USSR/FCR in Table 2) consists of estimates from Seliverstov and Serebrov (1979) for the years 1971-78 inclusive and for 1979-86 estimates are from the Canadian Observer Program (Foreign Cooperative Research Section, D. Kulka, pers. comm.). The estimates for 1972-78 are from BMRT-A class trawlers whereas the estimates for 1979-86 are from USSR Tonnage Class 7 trawlers but it is not known whether these trawlers are BMRT-A Class.

A catch rate series (1972-85) was also calculated using data from NAFO Statistical Bulletins for USSR trawlers Tonnage Class 7 (TC7) in which capelin comprised >50% of the catch (TC7 in Table 2).

Another catch rate series was generated using commercial data from ICNAF/NAFO Statistical Bulletins for the period 1972-83, provisional NAFO data for 1984 and 1985 and FCR data for 1986. These were input into a multiplicative model (Gavaris 1980) to derive a catch rate series. Because there has been some concern expressed about a postiori grouping of the items within the different categories, the same groupings as were used previously (Carscadden and Atkinson 1986) were used (Table 3). The data were weighted step-wise by effort and the minor corrections to the model reported by S. Gavaris (pers. comm.) were incorporated. Analysis details are shown in Tables 4 and 5 and in Figures 3 and 4. The regression results indicate significant differences between gears, months and years but not divisions. The resultant catch rate series is shown in Table 6 and Figure 5. The considerable difference in the 1985 point between the previous analysis (Carscadden and Atkinson 1986) and this one is due to the fact that FCR data were used previously and the differences between the FCR and NAFO statistics for 1985 is about 2 t/hr (6.96 vs 4.73).

Prior to 1985, NAFO statistics and FCR data agreed reasonably well (Fig. 6). The inclusion of the 1985 NAFO statistics in the multiplicative model produced a substantial drop in the calculated catch rate. In 1986, the FCR data also indicate a high catch rate.

Catch numbers (Table 7) and effort values (Table 6) from the multiplicative model were used to calculate catch rate-at-age indices (Table 8). Because of annual differences in maturation rates, emphasis on catch rates at age 2 only as an indicator of capelin abundance may be misleading. Most capelin have matured by ages 3 and 4, therefore, an examination of a year-class at ages 2 and 3 would probably be more appropriate in assessing year-class strength. This has the disadvantage of yielding less information on the 1984 year-class which will be an important year-class in the 1987 fishery.

An examination of the standardized year-class strengths indicates that the strongest year-classes in the series were the 1983, 1980, and 1973 year-classes. The 1974-76 year-classes were relatively weak and this contributed to a decline in the stock in the late 1970's.

Age compositions

The offshore commercial catch was dominated by the 1983 year-class (69%) followed by the 1984 year-class (21%) and the 1982 year-class (8%) (Fig. 7). While three-year-olds often contribute to the offshore catch, their contribution in 1986 was the greatest since 1976 when the strong 1973 year-class was present in the population. On the other hand, the two-year-old contribution was the weakest since 1978.

On a monthly basis, three-year-olds dominated in September-November while two-year-olds dominated in December; however, the December age composition is derived from only one sample (Table 9).

Details of the extent and distribution of sampling are given in Table 10.

Canadian groundfish surveys

Stratified-random groundfish surveys in Div. 2J3K have been conducted by GADUS ATLANTICA in most years immediately after the capelin acoustic survey. Tables 11 and 12 are updated from those presented by Carscadden and Atkinson (1986). The conclusions regarding capelin distribution from the results of the 1986 survey would be similar to those reached in Carscadden and Atkinson (1986); the acoustic coverage of strata that contained capelin during the groundfish survey is generally good in Div. 2J (Table 11) but not so complete in Div. 3K (Table 12). It is probable that the catch rates from groundfish surveys are more useful as indicators of distribution of capelin rather than as indices of abundance.

C. The 1986 Inshore Fishery in Div. 3K

Sampling Program

Commercial samples were collected by fishermen and at fish plants during the inshore capelin fishery in Div. 3K. The number of samples collected and analyzed from the fishery continued to increase in 1986. This was due to a general increase in landings from previous years and to good geographical coverage of the fishery based on a scheme to collect two samples per gear type per statistical section (Fig. 8) for each week of the fishery. A total of 83 samples were processed and 2748 otolith pairs were aged (Table 13). The mean number of otoliths per sample was similar among the three gear types (Table 13) and was less than the 40.7 otoliths averaged for capelin traps in 1985 (Nakashima and Harnum 1986).

Age Composition of the Fishery

The inshore catch in 1986 was dominated by the 1983 year-class as three-year-olds (Table 14). The 1982 year-class as four-year-olds was second in abundance. No two-year-olds were observed in the 1986 samples. Age compositions estimated in 1985 (Nakashima and Harnum 1986) were revised in this report (Table 14) due to the availability of more recent catch data. The changes were slight and the initial interpretation of the results still stands.

Research Logbook Survey

In 1986 research logbooks were distributed to 10 purse seine, 12 beach seine, and 16 capelin trap fishermen who reside in Div. 3K. A very high return rate was achieved from the 1986 logbook survey. There were 9 purse seine, 10 beach seines, and 14 trap logbooks returned. The remaining 5 logbooks were not returned. One purse seiner from Div. 3K fished only in Div. 3L in 1986 and his data were

excluded from this analysis. Five other purse seiners began fishing in Div. 3L and ended their season in Div. 3K.

For purse seiners, redfeed, a low percentage of females in the catch, and miscellaneous problems were given as primary reasons why capelin were discarded in 1986 (Table 15). The latter includes catches mixed with herring and discarding of capelin in excess of vessel capacity. As in previous years 'redfeed' was used to classify several other problems such as blackfeed and spawn in the stomach with those organisms generally associated with redfeed. Catch rejections in 1986 due to high redfeed levels were lower than 1985 for both purse seine (Table 15) and fixed gear (Table 16) fishermen in 1986. Beach seine fishermen had to contend with market problems, over ripe females, and picking out males to enhance the percentage of females in the catch. Discarding from traps resulted from poor market conditions and low percentages of females. A wide range of reasons was offered as shown in Table 16. Redfeed, a common problem in 1985, was not as prevalent in 1986. Market problems resulted from plant, boat, and person quotas which limited landings by individuals during the peak run.

Reported discards for all gear types declined from 1985 levels. From logbooks, discards were 29% of the reported purse seine landings (Table 17), 68% of the reported beach seine landings (Table 18), and 76% of the reported trap landings (Table 19). In most cases, capelin were released alive at sea. Discarding referred to capelin which were caught and not landed regardless of their being released alive or let down dead. The latter situation is known as 'dumping'.

Catch/effort data were available from 1981 to 1986 for purse seiners and from 1983 to 1986 for beach seines and traps. Catch/effort estimates for purse seiners increased from 1985 to 1986 (Table 17). The 1985 value was the highest in the series. The catch/set (C/S) index was the same in 1985 and 1986 (Table 17). Catch/effort indices from traps were the highest in the series (Table 19) and generally agreed with the trend observed for purse seine indices. The beach seine catch/effort suggested a decline in catch rates from 1985 values (Table 18).

The beach seine data were considered the least reliable of the three gear types for tracking abundance (Nakashima and Harnum 1986). In 1986 beach seines for 3 fishermen were a secondary gear used by trap fishermen between trap hauls when trap catches were low. The index for traps was thought to be the most reliable indicator of inshore abundance among the three gear types. Of the 4 indices calculated for each gear type, the C/D index is considered the most useful since it includes landings and discards for all fishing days. Both purse seine and trap C/D's increased from 1985 to 1986.

By-catches of cod and herring in traps were insignificant in 1986 (Table 19).

General Observations

The good fortunes of the fishery in 1986 were aided by a failure of the Norwegian Barents Sea capelin fishery and a large increase in mature biomass due to the presence of a strong 1983 year-class. Very few problems with selling capelin occurred since market needs were almost double the requirements in recent years. Discarding due to redfeed was not problematic since almost all capelin of varying redfeed levels were sold in 1986. The high average price per pound of 13.3¢ and the increase in landings (Table 1) indicate the success of the inshore fishery compared to the problems experienced in 1985 (Nakashima and Harnum 1986).

The logbook survey data continue to provide valuable data on the level of discarding and on catch/effort indices for the three gear types which predominate the fishery. The information for fixed gear fisheries is paramount since no other source of reliable effort data exists. In 1987 we will continue our efforts to expand the number of fixed gear logbooks used in the analyses.

D. Hydroacoustic Survey of Capelin in NAFO Div. 2J3K

This survey conducted during October 16-30, 1986 is part of an ongoing program of annual acoustic surveys of the SA2 + Div. 3K capelin stock conducted by both Canada and the USSR. Data were collected using the same equipment and survey design as in earlier years (Miller and Carscadden 1984). Acoustic data from previous hydroacoustic cruises (1983, 1984, and 1985) were reanalyzed using the model for attenuation coefficient described by Fisher and Simms (1977). Data from the earlier cruises were also analyzed using a new algorithm for removing groundfish echos in the near bottom zone. The reanalysis of the earlier hydroacoustic data makes the results from the 1983-86 surveys directly comparable.

Results

Figure 9 shows the acoustic survey track and the location of midwater trawl fishing sets made during the survey. Acoustic data from blocks A and D indicated very low pelagic biomass and the fishing sets from these survey blocks indicated that no capelin were present. Consequently, the results of biological and acoustic sampling are presented for blocks B and C only. Figure 10 shows the age and length composition of capelin from fishing sets made in blocks B and C. Three-year-old capelin of the 1983 year-class were predominant on both survey blocks. Mean length at age was higher for block C than in block B. Table 20 provides a summary of the acoustic survey results. Total capelin biomass was estimated at 430,964 t. Table 21 gives total numbers and biomass at age for acoustic surveys since 1983 as revised due to reanalysis with new attenuation coefficients and sampling algorithms.

Over the period 1983-86, only survey blocks C and D have contained concentrations of capelin in all years. Table 22 gives biomass estimates by age for blocks C and D combined for each of the four surveys years.

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Table 1. Inshore capelin landings (t) by gear, 1974-86.

Year	NAFO Div.	Purse seine	Ring net	Beach seine	Trap	Misc.	Total
1975	2J	-	-	-	-	-	-
	3K	-	-	613	86	-	699
	2+3K	-	-	613	86	-	699
1976	2J	-	-	1	-	-	1
	3K	-	-	1519	162	4	1685
	2+3K	-	-	1520	162	4	1686
1977	2J	-	-	-	-	-	-
	3K	-	-	1891	24	-	1915
	2+3K	-	-	1891	24	-	1915
1978	2J	-	-	-	-	-	-
	3K	-	25	1948	447	-	2420
	2+3K	-	25	1948	447	-	2420
1979	2J	-	-	-	-	-	-
	3K	-	168	461	42	-	671
	2+3K	-	168	461	42	-	671
1980	2J	-	-	-	-	-	-
	3K	-	560	655	139	-	1354
	2+3K	-	560	655	139	-	1354
1981	2J	-	-	-	-	-	-
	3K	-	1000	520	283	-	1803
	2+3K	-	1000	520	283	-	1803
1982	2J	-	4	4	-	-	8
	3K	-	1935	1544	381	-	3860
	2+3K	-	1939	1548	381	-	3868
1983	2J	-	-	4	-	-	4
	3K	2359	-	1062	344	-	3765
	2+3K	2359	-	1066	344	-	3769
1984	2J	-	-	1	-	-	1
	3K	3661	-	2338	1119	-	7118
	2+3K	3661	-	2339	1119	-	7119
1985	2J	-	-	1	-	-	1
	3K	3948	-	835	2584	-	7367
	2+3K	3948	-	836	2584	-	7368
1986*	2J	-	-	3	-	-	3
	3K	4039	-	2562	5061	-	11662
	2+3K	4039	-	2565	5061	-	11665

* provisional

Table 2. Commercial catch rate series for Div. 2J3K capelin, 1972-86.

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
USSR/FCR (t/hr)	2.81	3.29	4.56	6.47	5.27	4.14	2.29	1.34	4.57*	3.68	3.19	5.31	4.24	6.96	6.54
TC7 (t/hr)	2.65	2.75	3.62	4.51	3.62	4.00	2.34	1.35	4.92	3.72	3.36	4.51	3.86	4.16	
Multiplicative model	4.77	4.16	4.05	5.63	5.46	4.65	2.34	2.06	5.83	4.21	3.77	4.82	4.32	4.73	7.13

* considered to be an overestimate

Table 3. Parameter estimates from the analysis of catch/effort for capelin in Div. 2J + 3K using a multiplicative model.

Country-Gear-TC	Estimate	Month	Estimate
USSR-OTM7	0.000	APRIL	
BULGARIA-OTM7		MAY	-0.414
		JUNE	
POL-OTM7	-0.343		
ROM-OTM7		JULY	0.131
		AUGUST	
USSR-OTB7			
CUBA-OTM7	-0.550	SEPT.	
POL-OTM6		OCT.	0.000
		NOV.	
JAPAN-OTB6	-0.896	DEC.	
GDR-OTM7			
JAPAN-OTB7		DIVISION	
POL-OTB7	-1.107		
USSR-OTM5		2J	0.000
		3K	
JAPAN-OTB5	-1.813		
NORWAY-OTM5	-2.719		

Table 4. Regression of multiplicative model for capelin in NAFO 3M 2 + Div. 3K.

multiple r.....0.840
multiple r squared....0.706

analysis of variance

source of variation	df	sums of squares	mean squares	f-value
intercept	1	3.069e2	3.069e2	
regression	22	1.321e2	6.007e0	20.057
type 1 (gear)	6	5.660e1	9.433e0	31.499
type 2 (month)	2	4.107e0	2.053e0	6.857
type 3 (year)	14	4.211e1	3.008e0	10.043
residuals	184	5.510e1	2.995e-1	
total	207	4.942e2		

Table 5. Regression coefficients from the multiplicative model.

variable	coefficient	std. error	no. obs.
intercept	1.489	0.395	207
1	-1.859	0.249	3
2	-0.912	0.160	8
3	-1.115	0.148	16
4	-0.585	0.105	33
5	-2.746	0.302	2
6	-0.363	0.093	33
7	-0.433	0.145	10
8	0.123	0.084	36
9	-0.198	0.417	12
10	-0.235	0.410	16
11	0.094	0.406	25
12	0.065	0.406	24
13	-0.097	0.393	36
14	-0.784	0.395	28
15	-0.911	0.407	14
16	0.163	0.484	2
17	-0.190	0.423	6
18	-0.297	0.428	5
19	-0.057	0.411	9
20	-0.160	0.433	5
21	-0.070	0.433	5
22	0.329	0.407	16

Table 6. The predicted catch rate for capelin in NAFO SA2 + Div.3K from the multiplicative model

standards used variable numbers: 0 0

year	total catch	catch rate mean	s.e.	effort
1972	45107	4.766	1.816	9465
1973	134920	4.163	0.740	32405
1974	125596	4.047	0.495	31037
1975	197803	5.627	0.619	35155
1976	214642	5.457	0.689	39331
1977	150273	4.654	0.449	32286
1978	52528	2.340	0.244	22449
1979	10817	2.061	0.229	5248
1980	4795	5.832	1.603	822
1981	10195	4.206	0.680	2424
1982	9677	3.769	0.671	2567
1983	10442	4.824	0.652	2165
1984	17366	4.323	0.764	4017
1985	16838	4.730	0.836	3560
1986	16602	7.125	0.704	2330

average c.v. for the mean:0.162

Table 7. Number of capelin in catch ($x10^{-3}$) in Div. 2J3K offshore fishery, 1972-85 and effort (hr) from the multiplicative model 1972-86.

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
2	228	1306	1015	5554	790	157	247	351	102	400	499	293	439	626	150
3	1240	1539	2464	2487	7409	1578	843	47	91	89	119	353	216	269	493
4	406	2085	888	733	606	3170	575	11	24	24	9	55	107	26	59
5	55	262	616	165	77	329	518	14	3	13	3	4	13	14	5
6	7	14	49	43	16	45	28	13	2	1	1	1	.3	1	2
Effort (hr)	9465	32405	31037	35155	39331	32286	22449	5248	822	2424	2567	2165	4017	3560	2330

Table 8. Catch rate-at-age indices for capelin in Div. 2J3K offshore fishery, 1972-86.

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
2	24.09	40.30	32.70	157.99	20.09	4.86	11.00	66.88	124.09	165.02	194.39	135.34	109.29	175.84	64.38
3	131.01	47.49	79.39	70.74	188.38	48.88	37.55	8.96	110.71	36.72	46.36	163.05	5.38	75.56	211.59
4	42.90	64.34	28.61	20.85	15.41	98.19	25.61	2.10	29.20	9.90	3.51	25.40	26.63	7.30	25.32
5	5.81	8.09	19.85	4.69	1.96	10.19	23.08	2.67	3.65	5.36	1.17	1.85	3.24	3.93	2.15
6	0.74	.43	1.58	1.22	.41	1.39	1.25	2.48	2.43	.41	.39	.46	.08	.28	.86

Standardized by year-class

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
2		.12	.21	.17	.81	.10	.03	.06	.34	.64	.85	1.0	.70	.56	.91	.33
3	.62	.22	.38	.33	.89	.23	.18	.04	.53	.17	.22	.77	.03	.36	1.0	
2+3		.19	.31	.27	.89	.18	.11	.05	.46	.42	.55	.92	.36	.48	1.0	
2+3+4		.23	.32	.27	1.0	.21	.10	.11	.42	.37	.53	.86	.33	.47		

Table 9. Monthly age-composition (% by numbers) of Div. 2J3K capelin from the commercial fishery, 1986.

	Age					
	1	2	3	4	5	6
September	<0.1	16.6	74.6	8.3	0.3	0.2
October	<0.1	14.7	72.3	11.2	1.1	0.6
November	0.8	20.2	72.4	5.9	.6	.2
December	0.5	57.5	39.0	3.0		
All months	0.3	21.1	69.3	8.3	.7	.3

Table 10. Number of samples by month, monthly catch and proportion of catch observed by FCR personnel, and total monthly catch for commercial USSR fishery in Div. 2J3K.

	1979	1980	1981	1982	1983	1984	1985	1986
Div. 2J								
August	0/0/645			4/25/1286	0/0/253	0/0/481	0/0/333	12/51/3217
September	14/12/1616	12/100/1547	9/50/1947	16/55/4435	11/56/2326	10/49/3948	2/17/2763	18/45/7176
October	37/38/5676	17/92/3248	29/67/6793	7/21/3357	11/48/3898	6/22/7366	12/42/8129	
November	10/67/1155		3/43/1117	3/50/599	6/47/1731	17/66/3385	10/29/5341	
December	1/49/265		0/0/292		2/23/1561		0/0/272	
Div. 3K								
August	0/0/56							
September	0/0/43							
October	0/0/85				0/0/55			4/181/240**
November	0/100/5					3/100/0*		12/46/4478
December					0/0/573	9/53/2186		1/10/1492

* no catch in NAFO Stats but 570.5 t observed

** preliminary catch reported is lower than catch observed

Table 11. Capelin in 2J from groundfish surveys (average number/set). * = less than 50% of strata covered by Canadian acoustic survey, ** = greater than 50% of strata covered by Canadian acoustic survey.

Stratum	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
201	0	-	0	0	1.30*	0.83*	0.17	0 **	0	0
202	0	0	0	1.50	4.00	24.50	0	0.50**	0	0
203	0	0	0.67*	2.00*	0 **	0 **	0.33**	0 **	2.00**	0*
204	0	0	0 *	- *	0 **	0 **	0 *	0 *	0 *	0*
205	1.20	-	86.0 **	75.00**	1566.62**	103.50**	1.25**	0.25**	7.13**	0**
206	0.09	-	699.50**	458.29**	23.73**	3.72**	3.14**	3.64**	4.29**	0.09**
207	0	-	1.80**	0 **	6.89**	3.09**	0 **	0.43**	1.59**	0**
208	0	0	1.00**	0 **	0 **	2.33**	0 **	0 **	10.33**	-**
209	0	0	7.31**	1378.83**	1.00**	1.18**	0.51**	19.79**	1.00**	0.14**
210	0.17	0	0 **	0 **	2.00**	1.52**	0 *	4.25*	8.89*	278.33*
211	1.00	0	0.25	22.00**	0 *	1.00**	108.00*	1.50*	1.00*	0*
213	0	0	0 *	0 **	314.00**	4.90**	0 *	0.60*	1.67*	0*
214	0	0	0	0 *	0 **	1.75**	0.13**	0.25**	5.83**	0
215	0	0	0	0.25*	0 *	0.78*	0.38*	0 *	0 *	0
216	0	0	0	0 *	0.50*	0 *	0 *	0 *	0 *	0
217	0	0	0	0 *	0 *	0 *	0 *	- *	0 *	0
222	0	0	0	0 *	0 *	0 *	0	0	0	0
223	0	0	0	0 *	0	0	0	0	0	0
227	0	0	0	0	0	0	0	0.33	0	0
228	0	0	0	0	0	0	0	5.43	3.14	13.20
229	0	0	0	0	0	0	0	0	0	4.33
234	0.50	0	1.25**	0 **	1.50**	4.00**	0 **	0.60**	0 **	0.50**
235	0.75	0	0.50**	0 *	0 *	0.33*	0 *	0 *	0 *	0*
Av. no/set	0.15	0	62.14	128.02	164.12	10.73	2.45	2.83	2.51	10.42
Adjusted av. no/set			12.46	104.82	36.7					

Table 12. Capelin in 3K and combined 2J3K from groundfish surveys (average number/set). * = less than 50% of strata covered by Canadian acoustic survey, ** = greater than 50% of strata covered by Canadian acoustic survey.

Stratum	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
620	0.25	0	5.40**	0.08**	247.9 **	0.89**	96.10**	31.62**	46.50**	0.33**
621	-	0.20	1.09**	0 **	0.45**	48.36**	2.75**	10.43**	7.00**	86.67**
622	0	0	0 **	0 **	1.00**	0 **	23.50	2.75	3.00	0
623	0	0	0 **	5.83**	10.00**	0.40**	2.67*	5.00*	80.17*	1.0*
624		0	0 *	0 **	0 *	0 *	0.0	8.00	4.75	13.00
625		0	1.20*	0	0	0	0	0.80	0.60	15.00
626		0	1.20**	1.80**	0.20**	0 **	3.75*	4.17*	2.92*	0*
627		0.50	0 *	2.50	0.17*	0.43*	1.50	0	1.71	2.00
628		0	0.20	7.83	0	10.17	4.50	0.14	17.58	1.75
629		0	6.50	7.80	0	0	12.33	0.50	7.75	0
630		0	0.25	0.25	5.50	-	4.00	0	39.41	-
631		0	0	0.33	1.20	9.00	1.40	3.40	1.57	2.00
632		0	0	0	0	0	0	-	0	0
633		0	0.10	0	0.75	0	0	0	0	14.75
634		0	0.25	0.43	1.43	10.18	0	0.14	0.44	1.60
635		0	5.88	6.17	0.60	5.40	11.33	1.38	2.71	0.93
636		0	0.0	16.43	1.17	4.40	0	0.13	0.25	0
637		0.20	0.57	4.67	1.33	21.71	15.00	0.50	3.43	0.25
638		0	0.33	2.33	1.50	15.73	0.82	0	18.27	5.25
639		0	0	0.83	0.67	14.70	0	0	6.88	0.17
640		0	-	0	0	0	-	0	0	0
Av. no/set	0.13	0.05	1.28	2.60	26.94	10.67	13.14	5.46	13.11	15.80
Combined 2J3K			28.53	56.21	86.83	11.07	6.86	4.17	8.32	13.17
Combined 2J3K with adjusted 2J values			6.29	46.3	29.5	11.07	6.86	4.17	8.32	

Table 13. Summary of the commercial samples collected and aged from the 1986 inshore capelin fishery in Div. 3K.

Gear type	No. of LSM/strat samples	No. otoliths aged (N)	Mean no. otoliths ± SD per sample
Purse seine	17	557	32.8 ± 3.6
Beach seine	28	899	32.1 ± 5.8
Capelin trap	38	1292	34.0 ± 3.6
TOTAL	83	2748	

Table 14. Age-compositions (%) of capelin from the inshore commercial capelin fishery, Div. 3K, 1982-86.

	Age				
	2	3	4	5	6
Males					
1982	1.1	90.2	8.5	0.2	0.1
1983	0.2	65.0	34.8	0	0
1984	0	30.6	68.0	1.1	0
1985	0.6	61.7	34.7	3.0	0
1986	0	58.2	41.2	0.5	0
Females					
1982	0.8	79.4	10.7	7.4	1.7
1983	0	44.0	52.6	3.4	0
1984	1.5	38.0	54.1	6.2	0.3
1985	0.8	55.5	27.1	16.0	0.5
1986	0	61.3	34.7	3.0	1.0
Sexes combined					
1982	0.9	84.1	9.7	4.3	1.0
1983	0.1	62.4	37.1	0.4	0
1984	0.6	33.4	62.6	3.1	0.1
1985	1.5	57.2	29.5	11.5	0.4
1986	0	61.4	35.8	2.3	0.5

Table 15. Reasons (expressed as % by weight) reported in logbooks for discarding capelin in purse seines in Div. 3K, 1981-86.

Year	Low % females	Redfeed	Not mature enough	Small females	Females spawned out	No market	Over ripe	Misc.	Unknown
1981	90	6	4	0	0	0	0	0	0
1982	32	52	0	10	6	0	0	0	0
1983	5	48	0	4	0	42	0	0	1
1984	81	4	0	2	8	3	2	0	0
1985	6	52	0	0	5	2	0	33	3
1986	31	36	0	0	4	3	0	26	0

Table 16. Reasons (expressed as % by weight) reported in logbooks for discarding capelin from beach seines and traps in Div. 3K in 1983-86.

	Redfeed	Females over ripe	No market	Low % females	Males picked out	Females spawned out	Misc.	Unknown
Beach seine								
1983	47	3	37	6	7	0	0	0
1984	12	0	0	70	11	0	7	0
1985	13	0	64	23	0	0	0	0
1986	6	29	27	9	28	0	0	1
Trap								
1983	81	0	0	4	1	15	0	0
1984	1	0	17	51	19	4	8	0
1985	19	0	27	28	19	+	2	4
1986	10	16	27	30	7	3	6	0

Table 17. Capelin landings (t), discards (t), and catch/effort for purse seines in Div. 3K, 1981-86.

Year	No. fishermen	Landings		Discards logbook	No. days fished (D)	No. sets made (S)	L = Landings		C = Landings + discards	
		Statistics	Logbook				L/D	L/S	C/D	C/S
1981	10	533.9	725.0	92.9	89	118	8.2	6.1	9.2	6.9
1982	8	713.1	849.9	188.0	67	109	12.7	7.8	15.5	9.5
1983	14	808.2	1097.0	253.2	113	161	9.7	6.8	12.0	8.4
1984	10	854.1	928.0	297.1	87	127	10.7	7.3	14.1	9.7
1985	9	766.1	1067.2	551.5	98	129	10.9	8.3	16.5	12.6
1986	8		1053.9	310.0	76	110	13.9	9.6	18.0	12.4

Table 18. Capelin landings (t), discards (t), and catch/effort for beach seines in Div. 3K, 1983-86.

Year	No. fishermen	Landings		Discards logbook	No. days fished (D)	No. sets made (S)	L = Landings		C = Landings + discards	
		Statistics	Logbook				L/D	L/S	C/D	C/S
1983	6	118.6	139.4	39.5	44	79	3.2	1.8	4.1	2.3
1984	10	409.6	408.6	59.2	74	126	5.5	3.2	6.3	3.7
1985	4	59.5	61.6	47.7	17	19	3.6	3.2	6.4	5.8
1986	10		383.6	259.1	110	221	3.5	1.7	5.8	2.9

Table 19. Capelin landings (t), discards (t), and catch/effort for capelin traps in Div. 3K, 1983-86.

Year	No. fishermen	No. traps	Landings		Discards logbook	Bycatch		No. days fished (D)	No. times hauled (H)	L = Landings		C = Landings + discards	
			Statistics	Logbook		Cod	Herring			L/D	L/H	C/D	C/H
1983	3	3	87.3	85.8	51.3	6.0	24.9	41	48	2.1	1.8	3.3	2.9
1984	6	6	156.0	217.0	111.3	2.6	0.1	80	101	2.7	2.1	4.1	3.3
1985	9	9	172.6	212.0	209.9	2.8	0	132	123	1.6	1.7	3.2	3.4
1986	14	14		757.6	575.9	3.4	+	229	278	3.3	2.7	5.8	4.8

Table 20. GADUS ATLANTICA Cruise No. 130, Division 2J3K, October 1986.

	Block B	Block C
Mean density	16.3	14.6
Area (km^2)	13263	14692
Total biomass	216017	214947
No. of transects	8	12
No. of estimates	304	476
Delta	.97	.97
Lw limit delta	-.03	-.03
C of variation	58.2	18.8
Minimum density	1.0	2.3
Maximum density	85.5	34.2

Block B			Block C		
Transect no.	No. of intervals	Mean density	Transect no.	No. of intervals	Mean density
1	39	85.5	1	41	2.3
2	39	6.8	2	39	12.4
3	39	2.5	3	40	16.3
4	37	12.9	4	39	15.6
5	37	12.2	5	40	6.5
6	37	2.8	6	39	5.9
7	38	4.8	7	39	16.1
8	38	1.0	8	40	31.3
			9	40	34.2
			10	39	17.9
			11	40	3.6
			12	40	13.7

Combined total biomass is 430964

Table 21. Numbers (billions) and biomass (thousands of tons) at age of capelin from NAFO Division 2J3K hydroacoustic surveys.

Year	Cruise No.	Age	1	2	3	4	5+	Total
1986	130	#'s	0.1	6.9	11.8	1.3	0.1	20.2
		Biomass	0.6	113.2	278.9	33.5	4.7	430.9
1985	115	#'s	9.8	53.3	13.6	1.4	0.5	78.6
		Biomass	9.5	682.9	289.8	36.4	16.0	1034.6
1984	100	#'s	6.5	34.5	7.2	3.8	0.4	52.4
		Biomass	27.9	498.0	184.9	104.6	11.1	826.5
1983	85	#'s	2.6	2.5	1.4	0.2	<0.1	6.7
		Biomass	17.1	40.3	32.2	4.5	0.2	94.3

Table 22. Numbers (billions) and biomass (thousands of tons) at age of capelin from survey blocks B and C combined.

Year	Age	1	2	3	4	5+	Total
1986	#'s	0.1	6.9	11.8	1.3	0.1	20.2
	Biomass	0.6	113.2	278.9	33.5	4.7	430.9
1985	#'s	0.5	35.1	7.1	0.7	0.2	43.6
	Biomass	2.9	436.3	145.0	16.9	6.8	607.9
1984	#'s	5.4	9.9	1.6	0.9	0.1	17.9
	Biomass	20.0	123.0	44.7	24.6	2.3	214.6
1983	#'s	1.6	1.0	0.5	0.1	<0.1	3.2
	Biomass	11.1	15.6	12.7	1.9	0.1	41.4

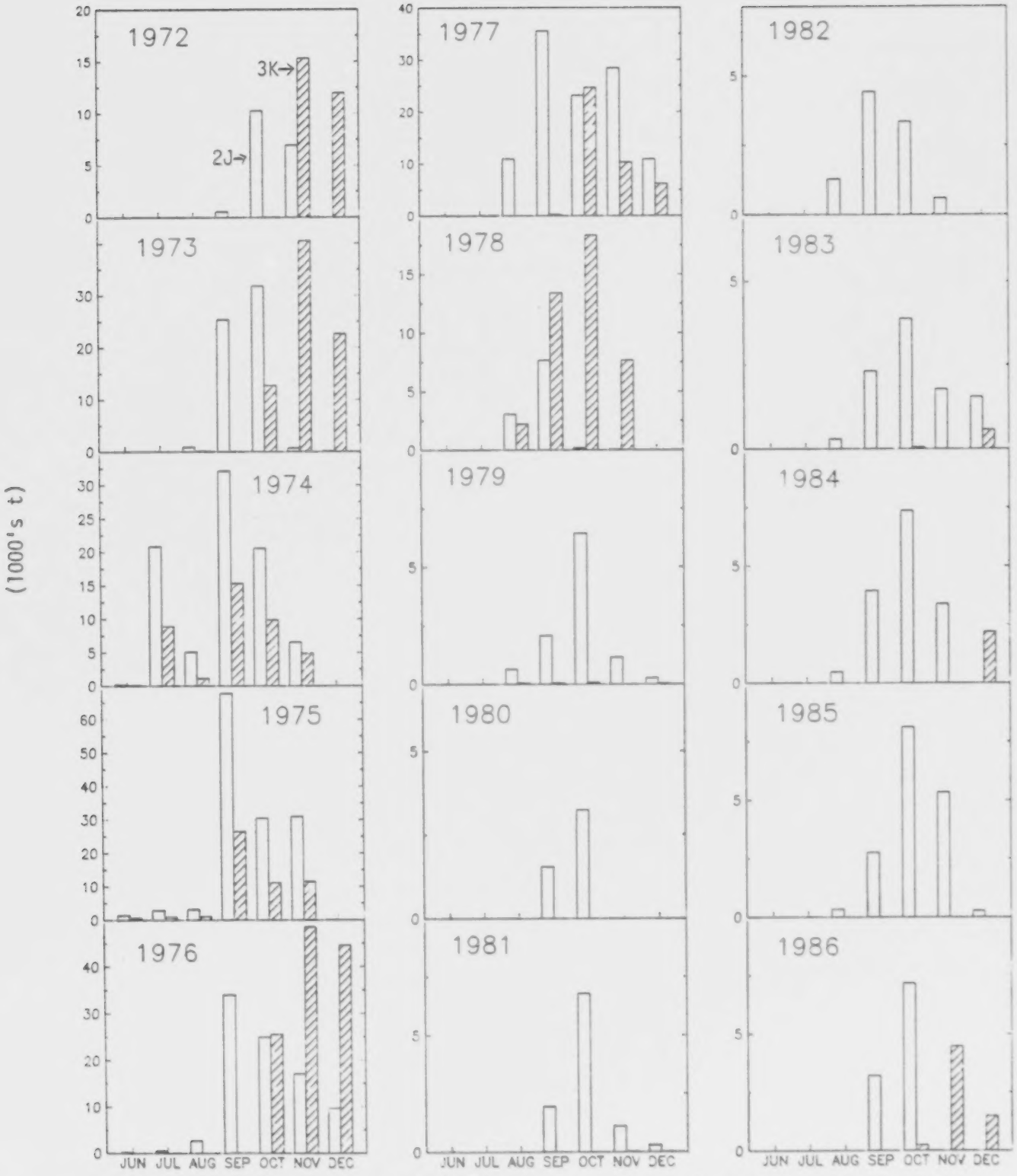


Figure 1. Commercial fishery catches (1000's of tons)

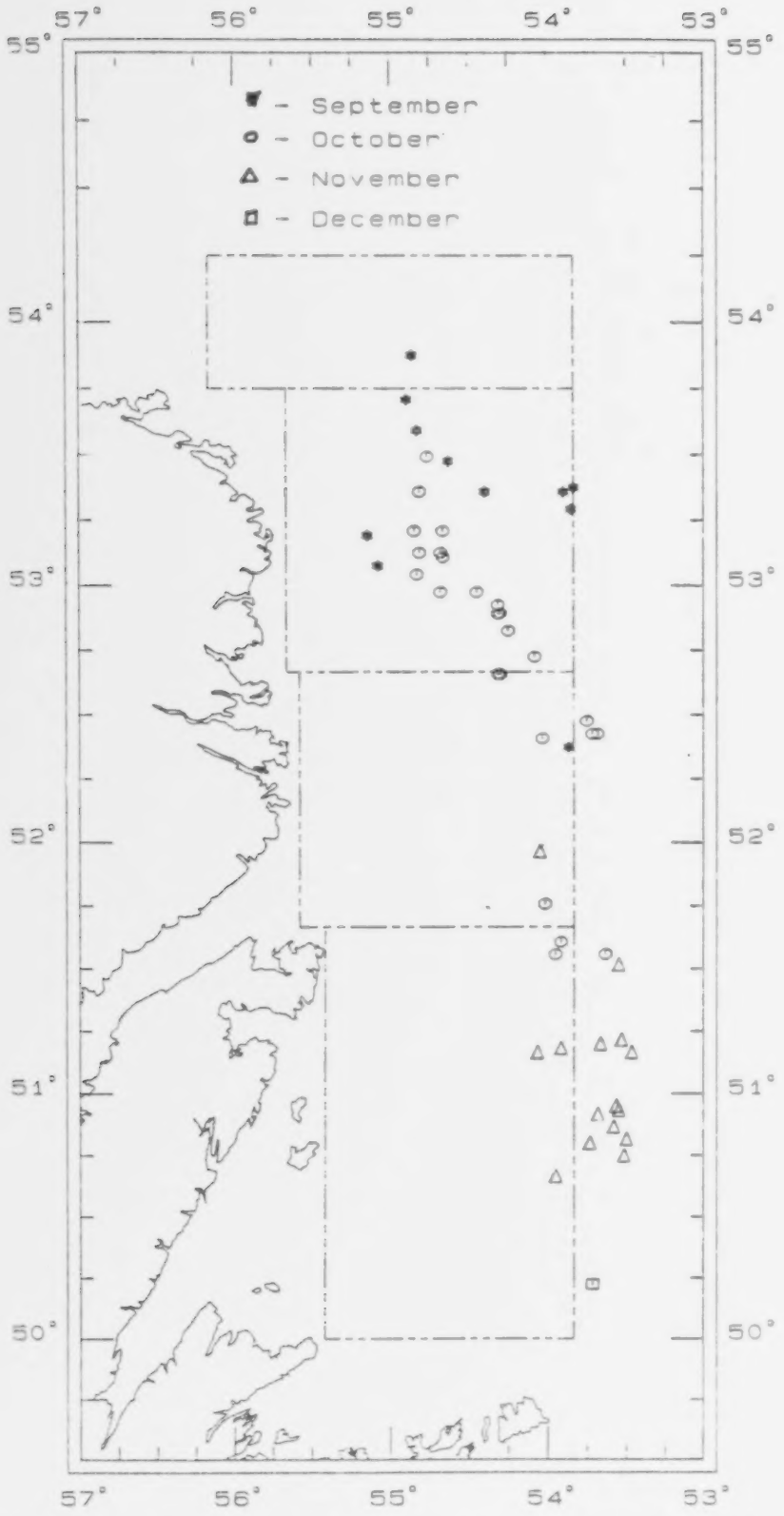


Figure 2. Distribution of the 1986 offshore commercial capelin catch by month

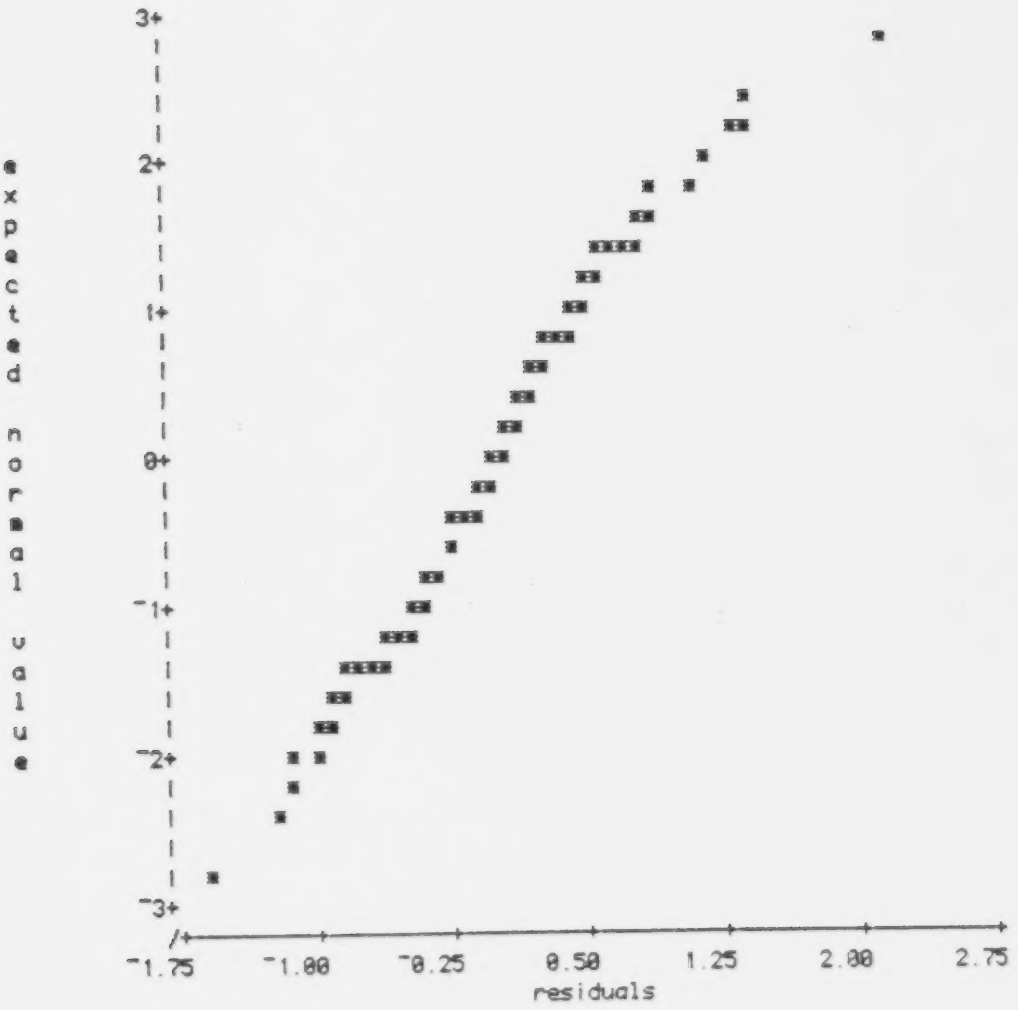


Fig. 3. : Plot of the residuals from the multiplicative model.

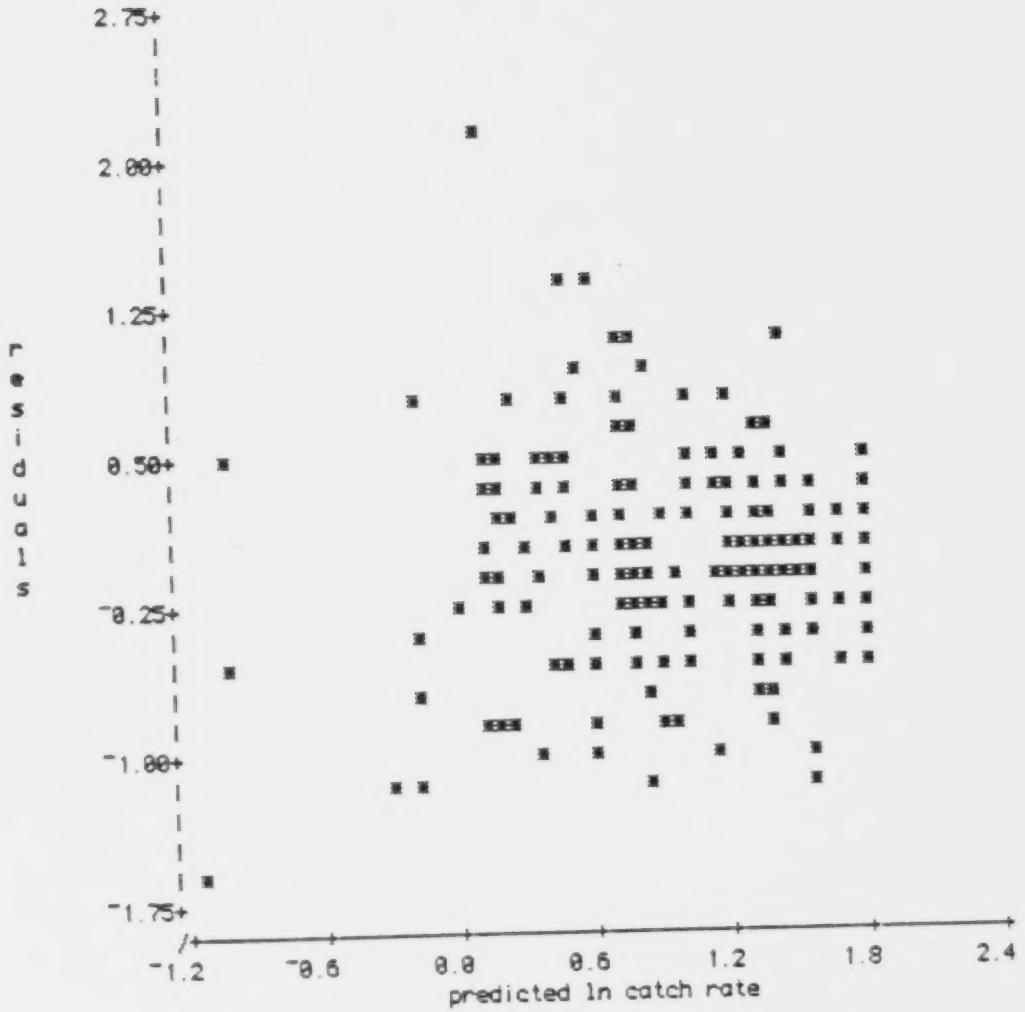


Fig. 4. Plot of the residuals from the multiplicative model.

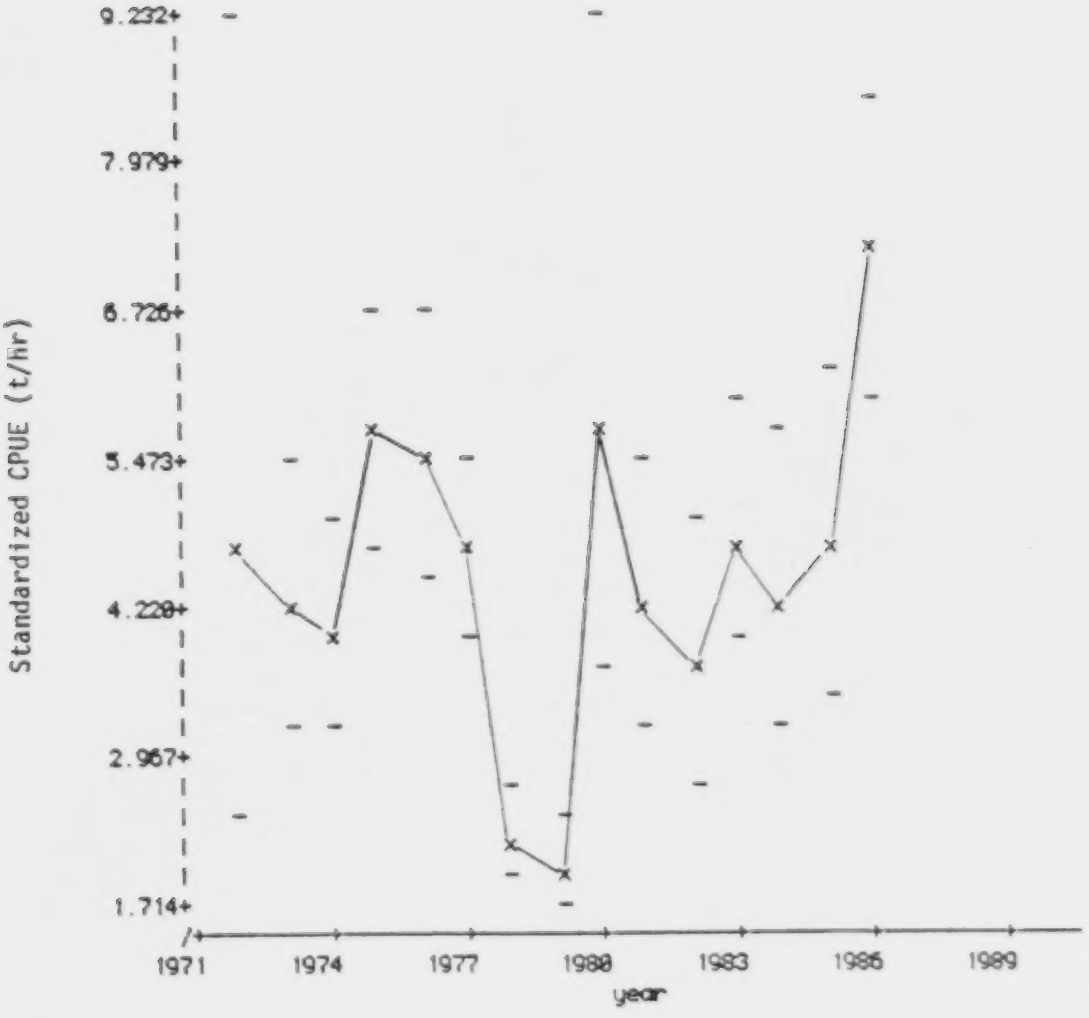
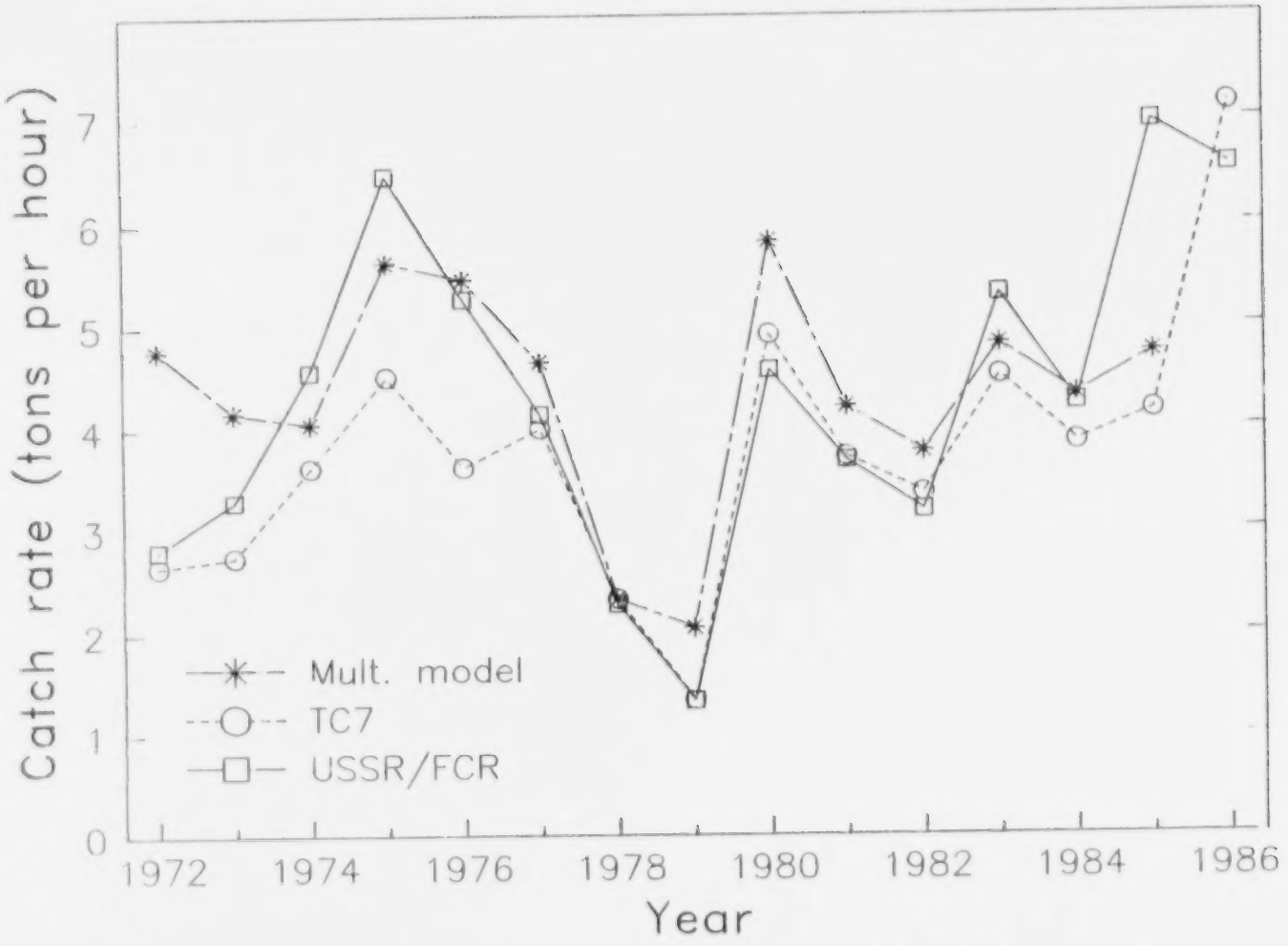


Fig. 5. Trends in catch rates for capelin in NAFO SA2 + Div. 3K, 1972-1985, as determined using the multiplicative model.

Figure 6. Commercial catch rates for 2J3K capelin 1972–1986



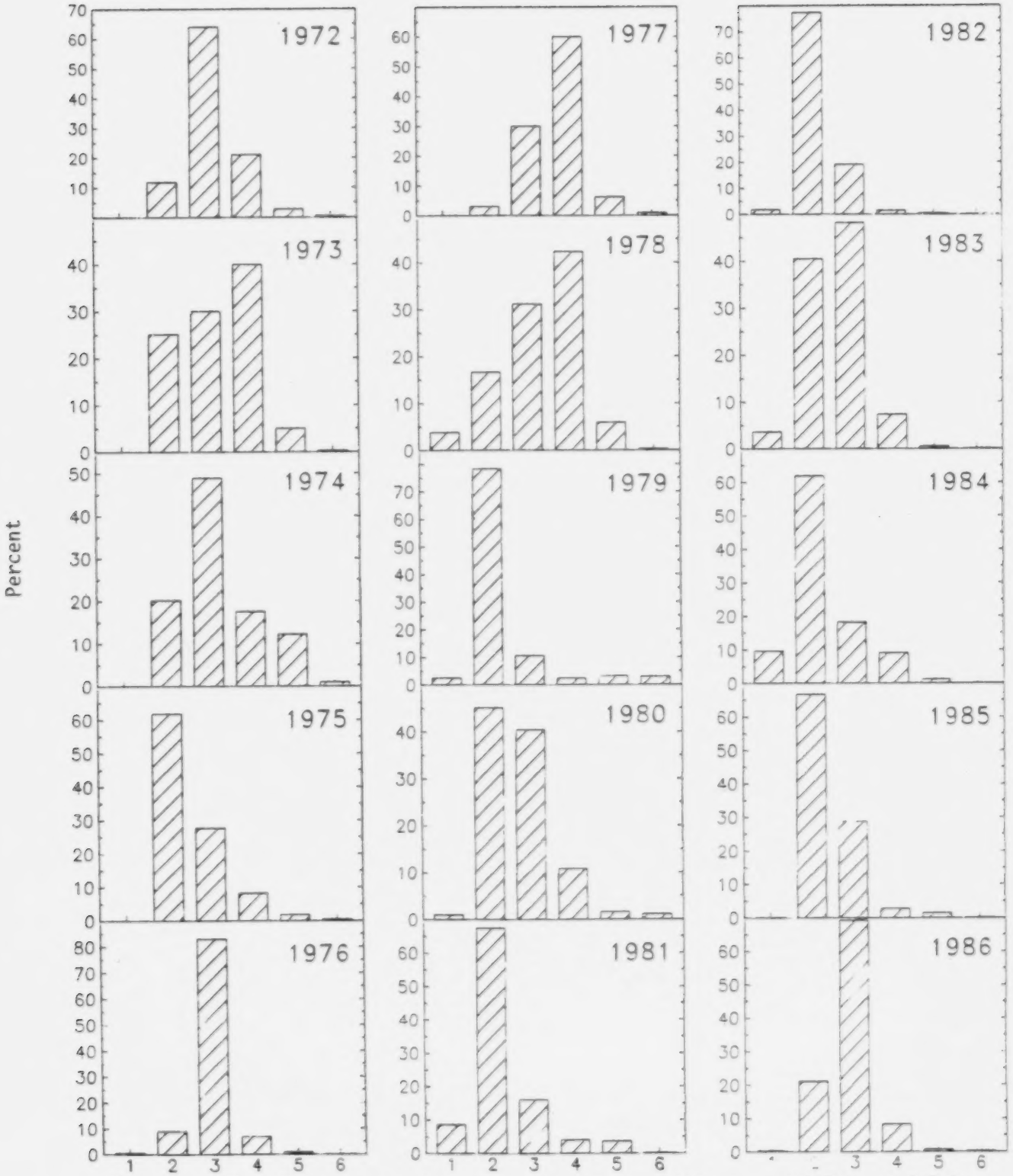


Figure 7. Commercial age composition 1972–1986

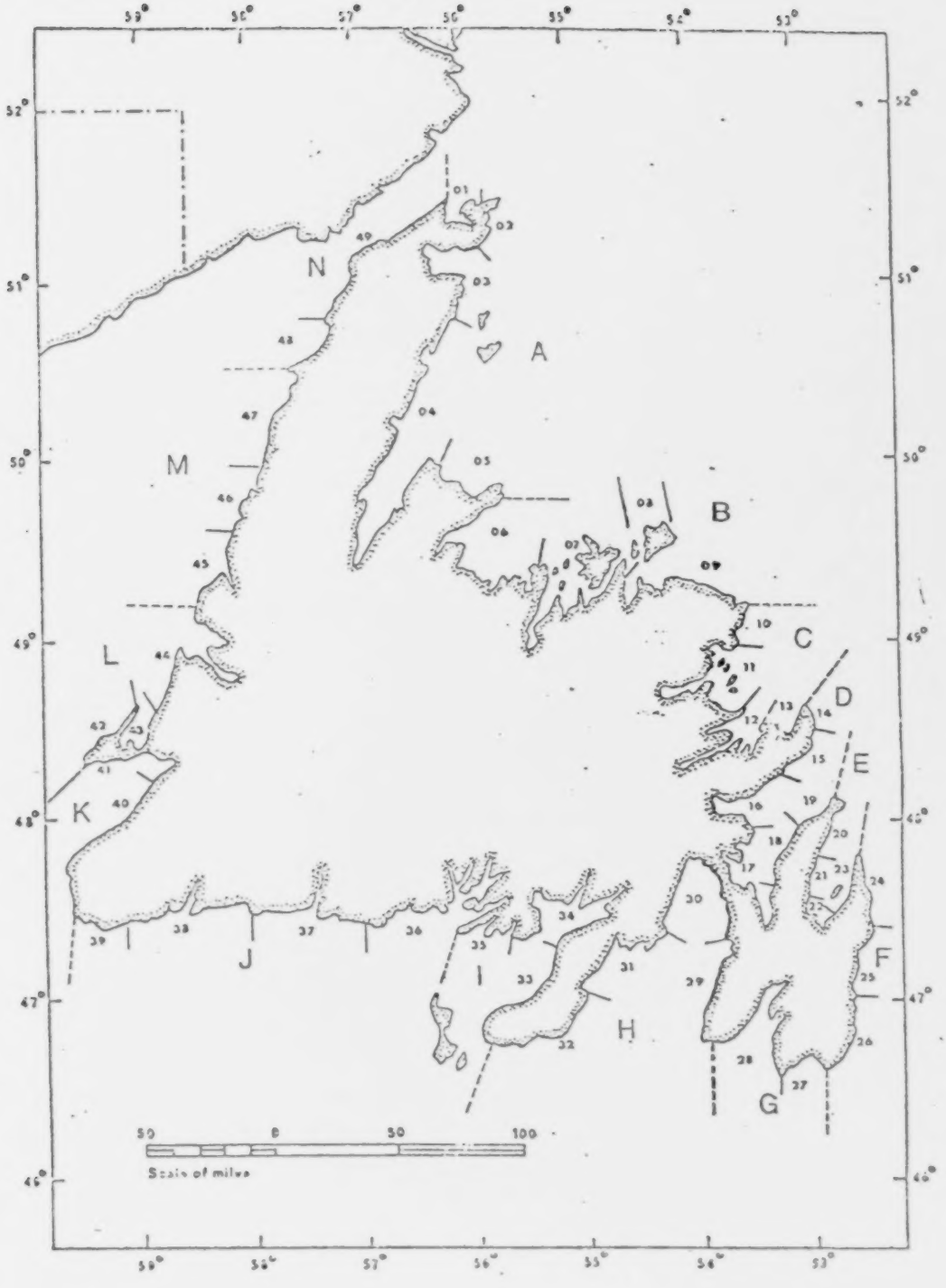


Fig. 8. Statistical areas (A = White Bay, B = Notre Dame Bay, C = Bonavista Bay, D = Trinity Bay, E = Conception Bay, F = Southern Shore, G = St. Mary's and Trepassey bays) and sections (numeric) in the Newfoundland region.

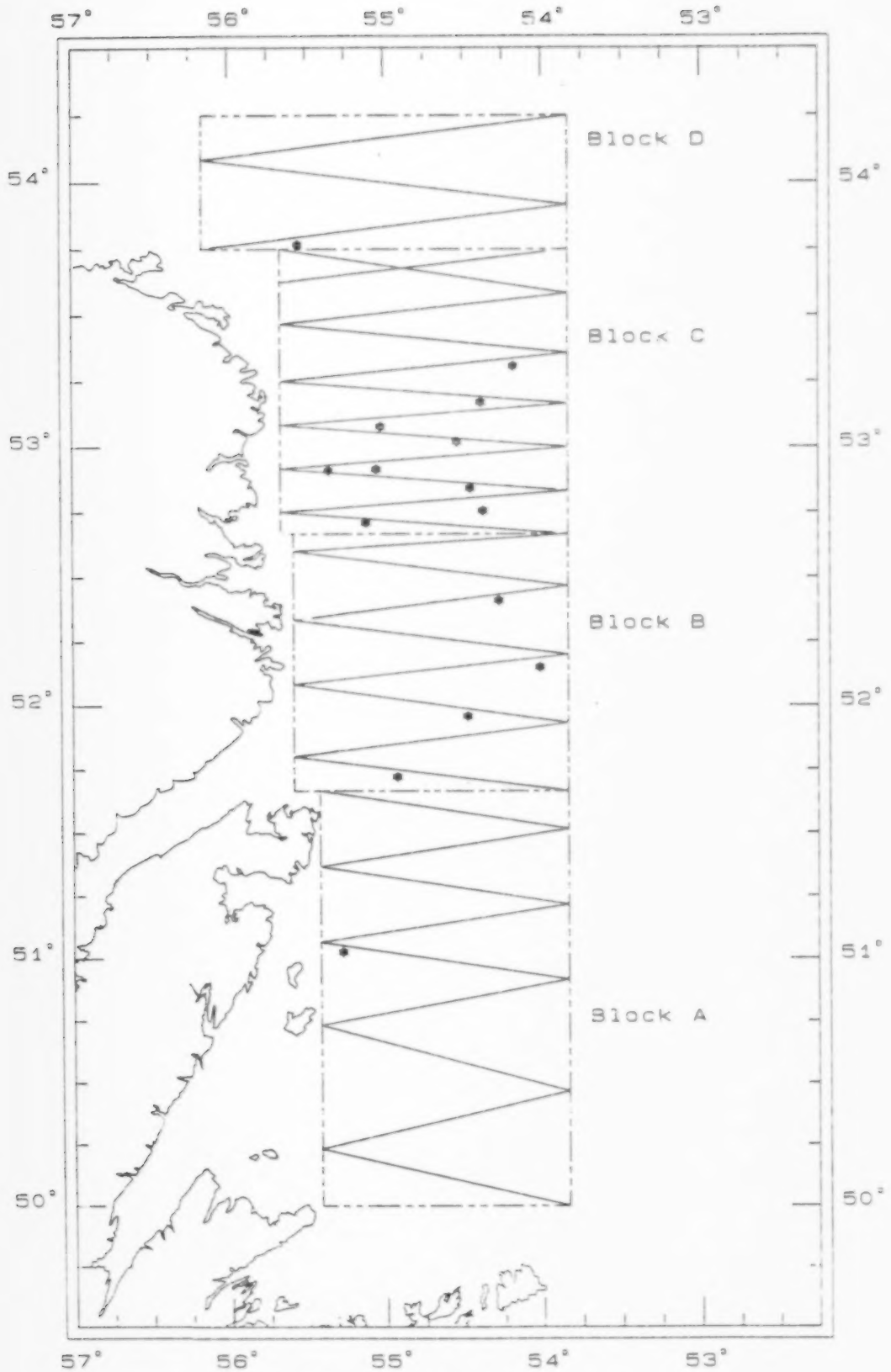


Figure 9. Acoustic cruise track and set locations for Gadus Atlantica cruise 130

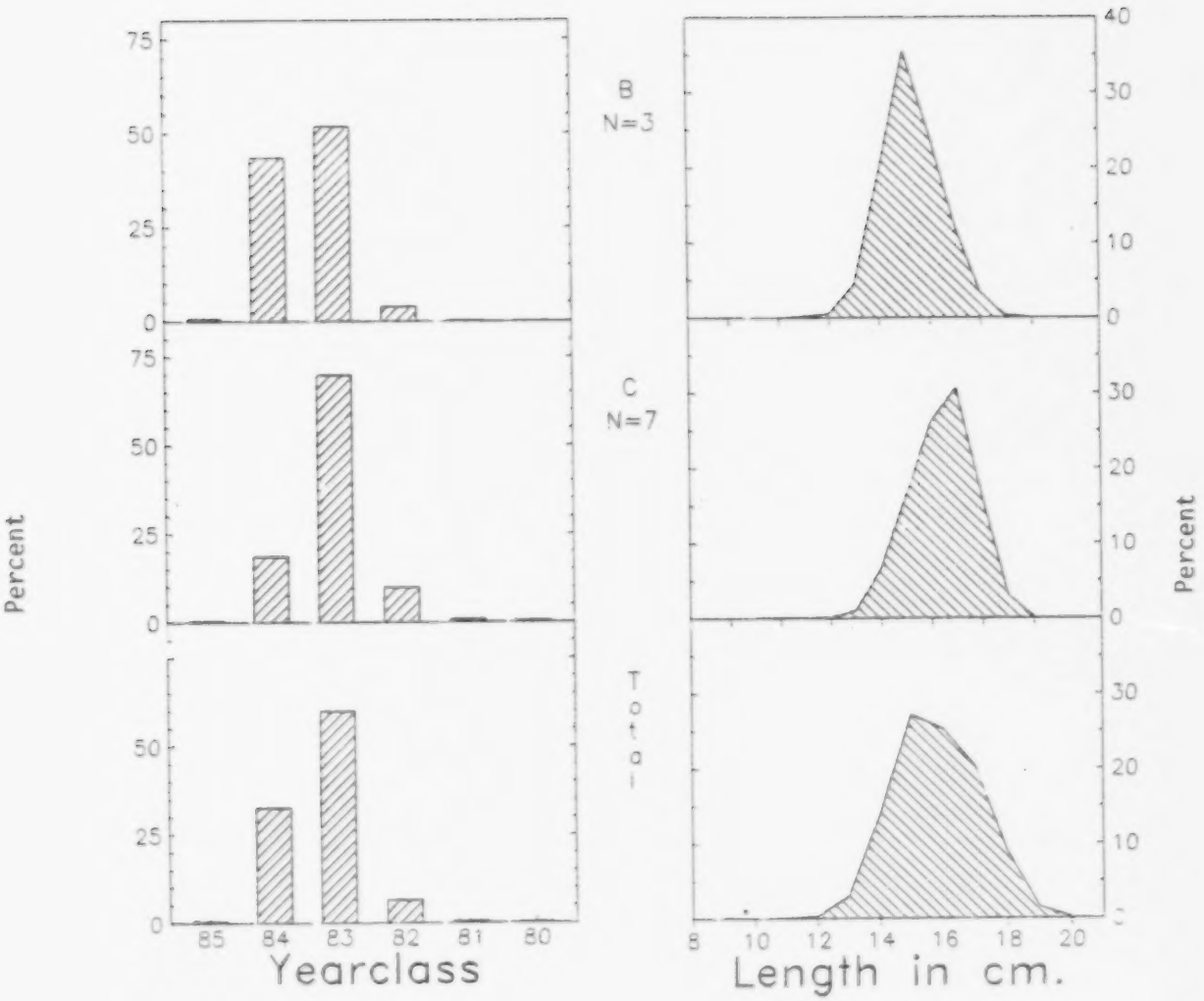


Figure 10. Age and length compositions from Gadus Atlantica Cruise 130